



THE UNIVERSITY OF KANSAS HEALTH SYSTEM

Common Youth Injuries

(and What You Don't Want to Miss)

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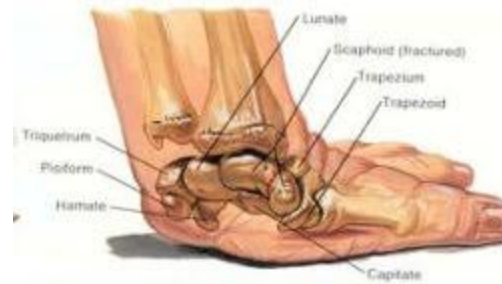
Objectives

1. Recognize common youth injuries and the proper initial management
 - a. Wrist injury
 - b. Knee injury
 - c. Back injury
 - d. Head injury

2. Identify and rule out potentially devastating differential diagnoses

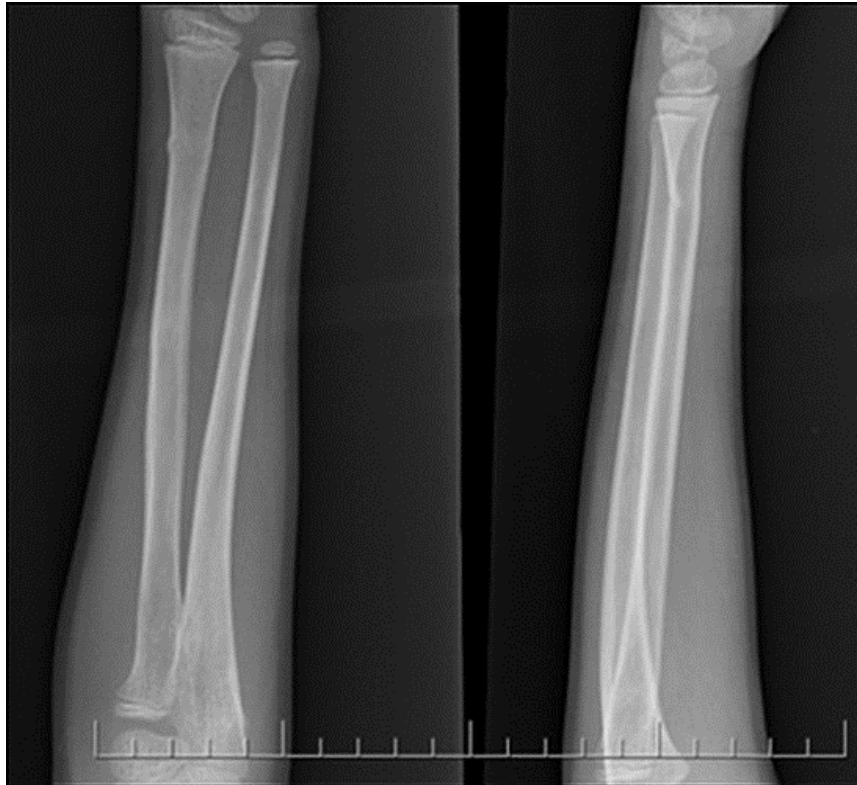
Case #1 Wrist Pain

- 10 y.o. male presents after suffering a fall off his bike yesterday. He landed on outstretched Right hand and felt sudden pain at right wrist. He has been guarding his arm and is unable to use his hand due to pain.



- Physical exam: Mild soft tissue swelling at dorsal distal forearm. +TTP at distal radius. Limited AROM but normal PROM with some discomfort. Diffusely tender at wrist joint. Neurovascular exam intact.

Imaging



Torus “Buckle” fracture



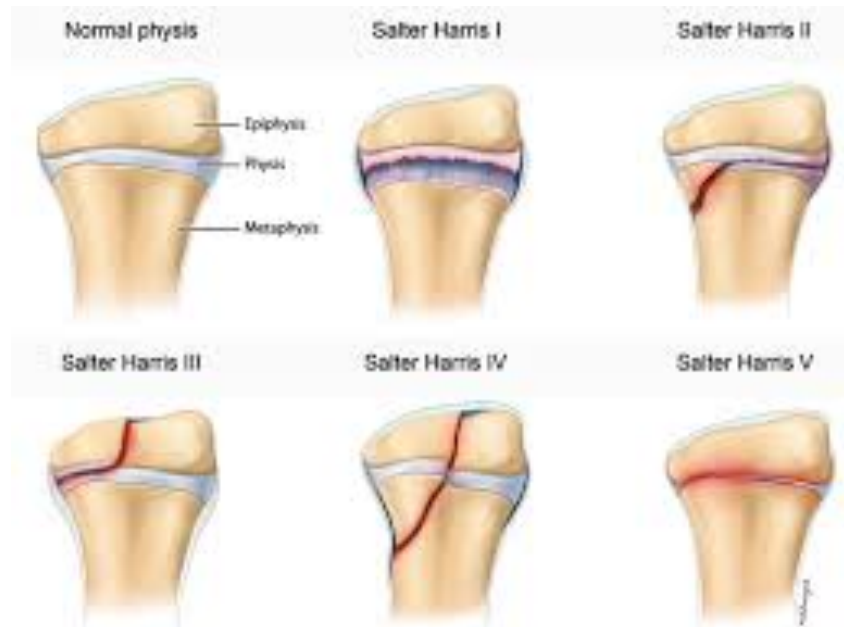
- **Treatment:** (Jiang et al. 2016)
 - Volar splint for 1 week
 - At 1 wk f/u: Splinting vs short arm cast for 2-3 weeks
 - 3-4 wk f/u: d/c if pain free on exam. Volar splint for sports x 2 wks
 - Stable; but one study showed 7% displacement

Greenstick Fracture

- Imaging:
 - cortical disruption
 - Look for angulation ($<10-20^{\circ}$)
- Treatment:
 - Short arm cast x 4-6 weeks.
 - Can still displace after 2 weeks
- If complete fracture:
 - Sugar thong splint and Long arm cast
 - Ortho Referral



Physeal Fractures- Distal Radius



- Non-displaced Salter-Harris I/II: short arm cast x 3-4 weeks
- Refer all others

Scaphoid Fracture

- + Snuffbox tenderness
 - + with radial deviation
- 3% of pediatric wrist fractures
 - Most common carpal fx



- Imaging:
 - Need Scaphoid view
 - **13% of fractures do not appear until 1-2 wks post-injury**
 - MRI vs repeat x-ray

Scaphoid Fracture

- Treatment:
 - Long arm thumb spica x 2 weeks → short arm thumb spica
 - Need to be pain-free and **radiologically healed**
 - 0.8% non-union (waist)
- Duration of immobilization:
 - Distal pole- 4-6 weeks
 - Waist- 10-12 weeks
 - Proximal pole- 12-20 weeks



Case #2 Knee pain

- 13 yo male with acute onset of right knee pain after falling directly on his knee during a basketball game. Has a history of intermittent knee pain during activities in the past year. Noticed a bump on his knee and is now reporting knee swelling.



- Physical Exam: Ambulates with mild limp. Prominent tibial tuberosity TTP with mild swelling. No effusion. No joint line tenderness. Ligamentous exam intact.

Imaging



Osgood Schlatter's Disease

- Traction Apophysitis at Tibial Tuberosity
 - Boys (10-15 yo) > Girls (8-12 yo)
 - Tight extensor mechanism

- Treatment: (self resolving)
 - Stretch extensor mechanism
 - Anti-inflammatories, icing
 - Patellar strap, chopat strap, knee sleeve

- Need for imaging?



Sinding-Larsson-Johansson (SLJ)



- Traction Apophysitis of inferior patellar pole
- Treatment:
 - Self-resolving with skeletal maturity
 - Quadriceps stretching
 - NSAIDs, sleeve, straps,...

Tibial Tuberosity Avulsion Fracture

- Boys >>> Girls
- Near end of skeletal maturity (12-15yo)
- Usually forceful eccentric quad contraction
- Exam:
 - Knee effusion, severe pain, ecchymosis
 - Inability to ambulate
- Risk of compartment syndrome, meniscal injuries
- Treatment:
 - Closed reduction if needed then Long Leg Cast x 6 weeks
 - Surgery if displaced
 - Knee immobilizer is OK



Patellar Sleeve Fracture

- Rare, usually 8-12 y.o.
- Separation of cartilage from ossified patella
- Exam:
 - Soft tissue swelling with effusion common
 - High riding patella
- Treatment:
 - Non-displaced: Long leg cast x 6 weeks
 - Displaced: Surgical fixation
 - Knee immobilizer

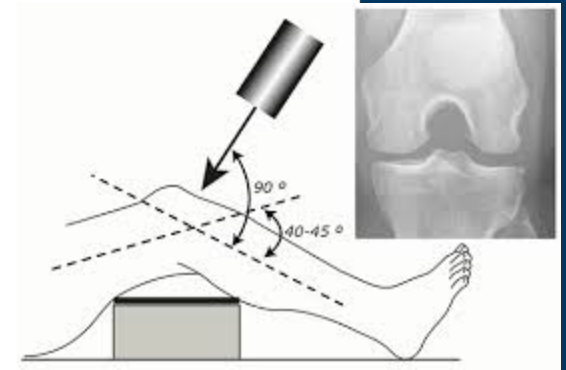


Case #3: Knee pain

- 11 yo with intermittent knee pain for at least 6 months. Location of pain is ill-defined but does have some pain at tibial tuberosity. Was diagnosed with Osgood-Schlatter in the past. Pain is worsening with activity, does not improve with warming up. Parents noted he has been walking with leg in slight external rotation.
- Exam: Mild prominence of tibial tuberosity with mild pain but different from complaint. Trace effusion. Ligamentous exam normal, +McMurray's at medial side.
- Recent knee x-rays were unremarkable

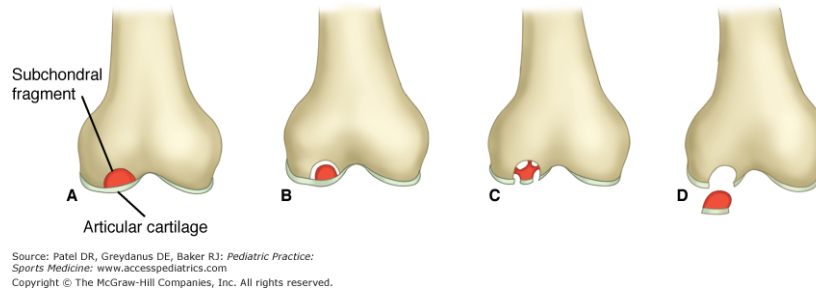
Imaging

- Get Tunnel (“Notch”) view (30-50° flexion)



Osteochondritis Dessicans (OCD)

- Lesion of articular cartilage and subchondral bone



- Epidemiology:
 - 10-15 yo Boys > Girls (Juvenile form)
 - 70% at posterior-lateral aspect of medial femoral condyle
- Pathophysiology:
 - Traumatic vs Hereditary vs Vascular

Osteochondritis Dessicans (OCD)

- Diagnosis:
 - X-ray with Tunnel view
 - Need MRI to stage lesion



- Prognosis:
 - Better with younger age, stable lesion

OCD-Treatment

- Stable lesion, open physes:
 - Protected weight bearing x 6 weeks
 - Avoid impact and shearing forces
 - Followed by 6 weeks Physical Therapy
 - Repeat MRI at 3 months
- Unstable or closing physes:
 - Surgery: screw fixation, microfracture, osteochondral graft
- What about incidental OCD??

Knee pain-Summary

- Almost always get x-ray!
 - Standing AP, Lateral, Merchant and Tunnel
- Knee effusion is Bad!
 - Almost always need MRI



- Rarely use knee immobilizer!

Case #4 Back Pain

- 16 y.o. gymnast with left lower back pain for 3 weeks. Initially mild but now unable to practice and difficulty walking. Sometimes radiates to left buttocks and posterior thigh. Exacerbated with activity, improved with rest. Diagnosed with lumbar back strain but no improvement with rest and stretches.



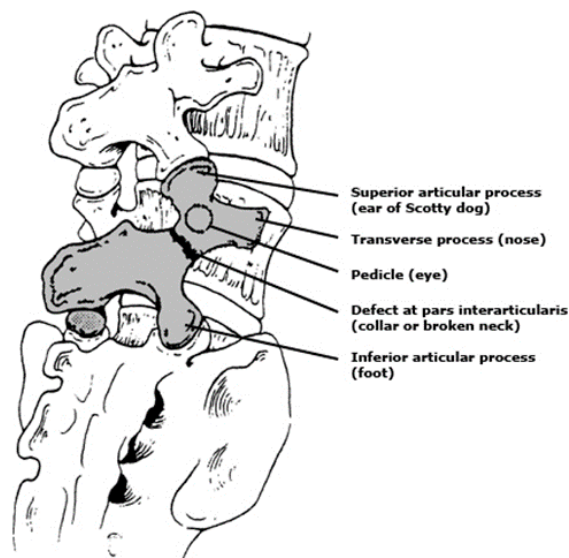
- Physical Exam: Very uncomfortable. Mild pain on forward flexion, more severe with extension. + Stork test on left. +TTP left paralumbar muscles. Equivocal straight leg test on left with tight hamstring. Strength testing seems symmetrical but limited on left due to pain, DTRs 1+ symmetrical, Sensation normal.
- Imaging: X-Ray unremarkable

Back pain in Adolescent Athlete

- 10-15% of young athletes
 - Up to 50% in football and 86% in gymnastics
 - Extension based sports stress posterior bony elements
- Differential: Disk disease, muscle strain, Pars injuries, malignancy, infection, rheumatic
- Different Etiology than Adults: (Micheli L.J., and Wood R)
 - **47% Pars injuries** (vs 5% in adults)
 - 11% Disk disease (vs 48% in adults)
 - 6% lumbosacral strain (vs 27% in adults)

Spondylolysis (Pars Injuries)

- Factors that predispose adolescents
 - Young healthy disks much less likely to be injured
 - Neural arch weakness?
 - Rapid growth may lead to muscle and tendon imbalance
 - Ossification of posterior column may be incomplete at superior pars of lower vertebrae
 - Increases risk of pars stress fractures

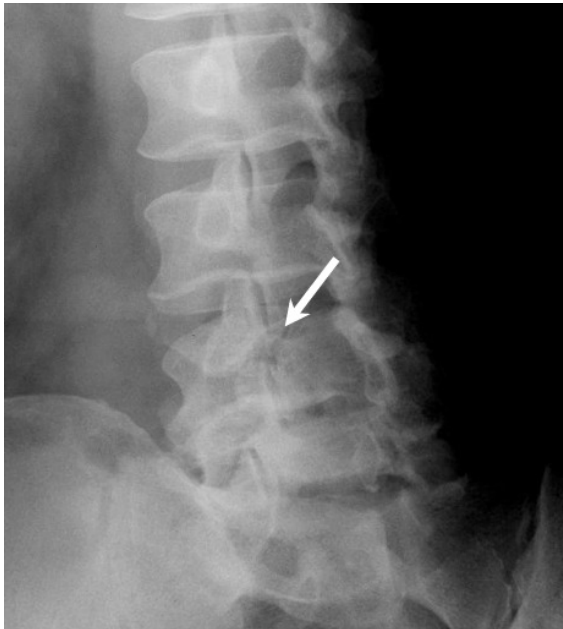


Spondylolysis (Pars Injuries)

- Risk factors:
 - Lower extremity injuries and muscle imbalances
 - Previous back pain
 - High volume of activities-extension and rotational sports
 - Poor technique
 - Hamstring tightness, weak core/hip abductors, thoracic kyphosis—increase posterior element stress

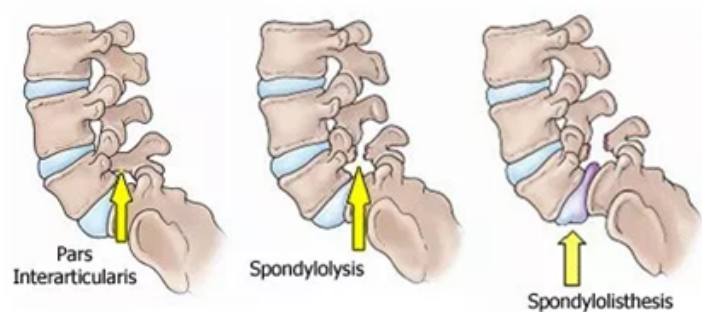
Back to our case...

- Ordered MRI
 - greatly affects management
 - X-ray usually normal
 - Is lesion "hot"?



Why do we need MRI?

- Early diagnosis to prevent:
 - nonunion +/- chronic pain
 - spondylolisthesis (if bilateral)
 - Need for surgical treatment
- Return to Sports:
 - No increase risk of listhesis with sports participation (DeLuigi et al)



Management of Spondylolysis

- Activity Modification with +/- Bracing
- Rest → PT progression → f/u at 6 weeks
- Can progressively return to sports as tolerated
 - At 3 months or earlier if continue wearing brace

- No Good Data



Pars injuries- Summary

- Extension-based back pain is a Pars injury unless proven otherwise!!
- Pain worsened with activity, improved with rest
- Get MRI
 - Early recognition is important
- Management:
 - Shutdown and return when pain-free
 - Brace vs no brace

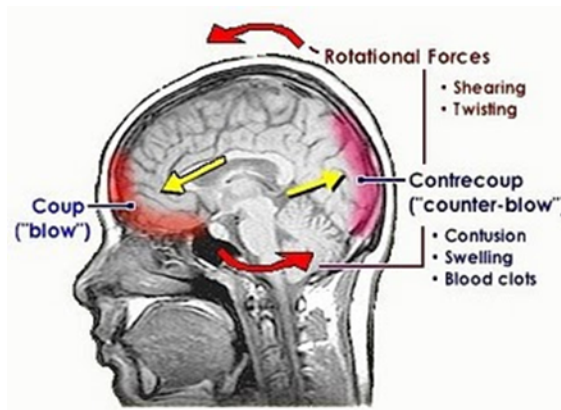
Case # 5 Head injury

- 17 y.o. High School football player presents to clinic 2 days after getting tackled during a football game. Immediately after the hit he felt “wobbly” and had a headache. Since then he has had intermittent headaches and feels “not like himself”.
- He was removed from game and told to see a doctor for clearance prior to return to play.







Concussion Definition

- Traumatic brain injury induced by **biomechanical forces** caused either by a **direct blow** to the head, or by transmission of impulsive force **transmitted** to the head causing a short-lived **neurological impairment**.
- It is a **functional disturbance, not a structural one**.



Concussion Symptoms

 Thinking/ Remembering	 Physical	 Emotional/ Mood	 Sleep
Difficulty thinking clearly	Headache Fuzzy or blurry vision	Irritability	Sleeping more than usual
Feeling slowed down	Nausea or vomiting (early on) Dizziness	Sadness	Sleep less than usual
Difficulty concentrating	Sensitivity to noise or light Balance problems	More emotional	Trouble falling asleep
Difficulty remembering new information	Feeling tired, having no energy	Nervousness or anxiety	

Imaging?

STEP 1: RED FLAGS

RED FLAGS:

- Neck pain or tenderness
- Double vision
- Weakness or tingling/ burning in arms or legs
- Severe or increasing headache
- Seizure or convulsion
- Loss of consciousness
- Deteriorating conscious state
- Vomiting
- Increasingly restless, agitated or combative

Clinic Evaluation

- Concussion Symptom Checklist
- Physical Exam
- Neurocognitive testing

Concussion Symptom Checklist

STEP 2: SYMPTOM EVALUATION

The athlete should be given the symptom form and asked to read this instruction paragraph out loud then complete the symptom scale. For the baseline assessment, the athlete should rate his/her symptoms based on how he/she typically feels and for the post injury assessment the athlete should rate their symptoms at this point in time.

Please Check: Baseline Post-Injury

Please hand the form to the athlete

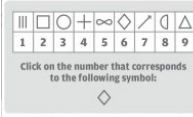


	none	mild		moderate		severe		
Headache	0	1	2	3	4	5	6	
"Pressure in head"	0	1	2	3	4	5	6	
Neck Pain	0	1	2	3	4	5	6	
Nausea or vomiting	0	1	2	3	4	5	6	
Dizziness	0	1	2	3	4	5	6	
Blurred vision	0	1	2	3	4	5	6	
Balance problems	0	1	2	3	4	5	6	
Sensitivity to light	0	1	2	3	4	5	6	
Sensitivity to noise	0	1	2	3	4	5	6	
Feeling slowed down	0	1	2	3	4	5	6	
Feeling like "in a fog"	0	1	2	3	4	5	6	
"Don't feel right"	0	1	2	3	4	5	6	
Difficulty concentrating	0	1	2	3	4	5	6	
Difficulty remembering	0	1	2	3	4	5	6	
Fatigue or low energy	0	1	2	3	4	5	6	
Confusion	0	1	2	3	4	5	6	
Drowsiness	0	1	2	3	4	5	6	
More emotional	0	1	2	3	4	5	6	
Irritability	0	1	2	3	4	5	6	
Sadness	0	1	2	3	4	5	6	
Nervous or Anxious	0	1	2	3	4	5	6	
Trouble falling asleep (if applicable)	0	1	2	3	4	5	6	
Total number of symptoms:							of 22	
Symptom severity score:							of 132	
Do your symptoms get worse with physical activity?							Y	N
Do your symptoms get worse with mental activity?							Y	N
If 100% is feeling perfectly normal, what percent of normal do you feel?								

Physical Exam

- Balance:
 - Single leg balance (hands on hip; eyes closed) x 20 sec
 - Tandem stance (hands on hip; eyes closed) x 20 sec
- Vestibular/ Occular-motor Screen
 - Smooth pursuit, saccades and near convergence
 - VOR and Visual motion sensitivity
- Neurocognitive testing (Impact test)
 - Supplemental tool only; No good studies

Sample questions from ImPact test

The ImPact test is administered at the start of a sports season to determine an athlete's baseline results, and again following a concussion to determine if his or her brain has recovered from the trauma. The memory and recognition tests, samples shown below, are conducted in conjunction with a general healthy history questionnaire and a survey of recent symptoms.

SYMBOL MATCHING Evaluates visual processing speed, learning and memory	DESIGN MEMORY Evaluates attentional processes and visual recognition memory	COLOR MATCH Evaluates reaction time, impulse control/response inhibition
		
<p>Symbols are shown with corresponding numbers. As a symbol is displayed below, the subject must click on the matching number above. After 27 matches, the subject must remember the correct symbol-number pairing.</p>	<p>Twelve designs are presented for 750 milliseconds, twice to facilitate learning. The subject is then shown a series of correct and incorrect designs and asked if each was displayed previously.</p>	<p>Some words are displayed in their matching color (e.g. RED appears in a red color) and some do not (e.g. BLUE appears in a green color). The subject is instructed to quickly click on the word box only if the word and color match.</p>
<small>SOURCE: ImPact</small>		<small>LAURA SPARKS - State Journal</small>

Natural History

- Symptoms usually last less than 72 hours
- Most concussions (>90%) resolve spontaneously within 7-10 days
- Almost all will recover by 4 wks (Post-concussion Syndrome)
- Children and adolescent may be at higher risk of prolonged recovery
- Predictors of longer recovery: (Iverson et al . 2017)
 - **Most consistent predictor is severity of acute and subacute symptoms.**
 - Hx of previous concussions
 - Post- injury amnesia
 - Hx mental health problems (ADHD, Learning disabilities are debatable)

Management

- **No return to play** on same day if suspected
- Relative rest 24-48 hrs- allow activity as long as sub-symptomatic. Early activity is beneficial.
- RCT compared strict 5-day vs 24-48 hrs rest (Thomas et al. 2015)
 - No benefit to strict rest (at 3 and 10 days post-injury)
 - Increased symptom reporting in strict rest
- RCT for early exercise testing with Buffalo treadmill test (Leddy et al. 2018)
 - 54 adolescents randomized: early exercise testing vs no testing
 - No difference in rate of recovery between groups
 - HRt strongly correlated to recovery time-potentially helps planning for school and team
 - Exercise prescription with HR targets??

Return to Learn/Play

- Start with **Return to School**

Consensus statement

Table 1 Graduated return-to-sport (RTS) strategy

Stage	Aim	Activity	Goal of each step
1	Symptom-limited activity	Daily activities that do not provoke symptoms	Gradual reintroduction of work/school activities
2	Light aerobic exercise	Walking or stationary cycling at slow to medium pace. No resistance training	Increase heart rate
3	Sport-specific exercise	Running or skating drills. No head impact activities	Add movement
4	Non-contact training drills	Harder training drills, eg, passing drills. May start progressive resistance training	Exercise, coordination and increased thinking
5	Full contact practice	Following medical clearance, participate in normal training activities	Restore confidence and assess functional skills by coaching staff
6	Return to sport	Normal game play	

NOTE: An initial period of 24–48 hours of both relative physical rest and cognitive rest is recommended before beginning the RTS progression.

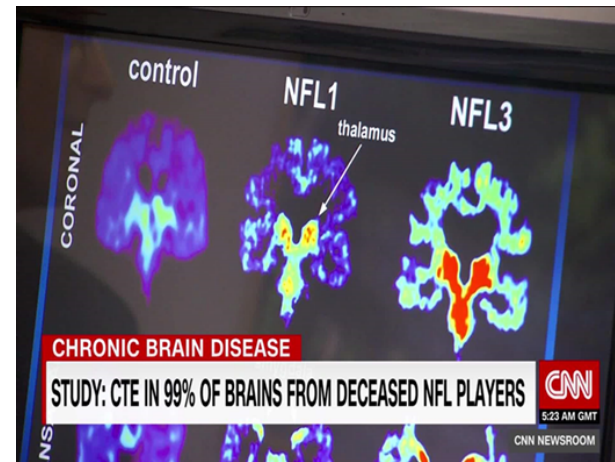
There should be at least 24 hours (or longer) for each step of the progression. If any symptoms worsen during exercise, the athlete should go back to the previous step.

Resistance training should be added only in the later stages (stage 3 or 4 at the earliest). If symptoms are persistent (eg, more than 10–14 days in adults or more than 1 month in children), the athlete should be referred to a healthcare professional who is an expert in the management of concussion.

(McCroory et al. 2016)

How About CTE??

- **What do we know?**
- It is a PATHOLOGICAL Dx only
- Concussions are a risk factor for Tau protein deposition
- Likely Proportional to Trauma burden
 - Age of first trauma
 - Cumulative trauma
- **What do we not know?**
- True incidence and prevalence
- How to diagnose
- Cause and effect between pathology and symptomatology
- Does Tau protein deposition mean anything??



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Thank you!